

Structural Metallic Materials by Infiltration

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Infiltration processing consists in the injection of a molten matrix material into open pores of a solid preform, followed by solidification. This process is suited for the production of composites, microcellular materials and also reaction compounds. Materials thus produced can generally be tailored with very wide latitude, and produced to high microstructural quality. This presentation will provide an overview of research in the authors' laboratory on aluminium-based composites and microcellular metal foams produced by infiltration.

Infiltration typically produces ceramic particle reinforced metal matrix composites featuring a comparatively high volume fraction of ceramic (around 50%). Our work to date on ceramic particle reinforced aluminium and aluminium alloys has shown that, despite the high ceramic loadings, these composite materials can be made to display strength and toughness values that match those of current engineering high-strength aluminium alloys. The physical and mechanical properties of these composites will be discussed, to highlight microstructural features and mechanisms that make these materials interesting from both standpoints of engineering and materials science.

Open-pore microcellular aluminium foams are produced by infiltration of NaCl powder preforms, which are leached with water to leave controlled pore volume fractions roughly varying between 65 and 90%. The foams can be produced to feature good microstructural homogeneity over a comparatively wide range of metal alloy compositions or pore sizes. They furthermore serve as attractive model materials for the investigation of microstructure/property relations in metal foams because of their macroscopically uniform and fine-scale microstructure, which is free of defects or edge-effects commonly found with current closed-pore foamed metals. The influence of metal microstructure and pore size and structure, will be discussed based on recent experimental data on infiltration-processed metal foams.